Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

MINOR STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF CORNELL UNIVERSITY

LV. Cutaneous Localization and the "Attribute of Order"

By H. M. Lufkin

In 1911 H. J. Watt proposed to add an original attribute of 'order' to the recognized list of sensory characters.[1] We believe that the addition is unwarranted. A Minor Study is not the place for systematic discussion; but we may touch very briefly upon the principal questions at issue.

(1) Watt has failed to realize that quality is itself an orderly attribute. All the visual qualities, e. g., have their determinate 'places' in the color pyramid; and a like law holds for smells and tastes (Henning) and probably for touches (Titchener). The isolated quality (as, e. g., Watt's "quality as such or mere sound") is by all analogy suspect. We expect in every case to find one or more qualitative series; we expect that auditory qualities will show an orderly arrangement; and Watt's "order or pitch-place" need therefore be nothing more than differentiated auditory quality. (2) Kaila has shown, in the crucial instance of crossed and uncrossed double images, that a different spatial localization of identical visual impressions may be explained physiologically, in terms of an 'empiristic' theory.[2] What holds of the two retinas will hold also of the two hands, etc. We need not commit ourselves outright to Kaila's view; it is enough for the present purpose to note that it offers a reasonable alternative, in the field of spatial perception, to Watt's postulate of an attributive 'order'. (3) Descriptive psychology knows less of protensive than it knows of extensive sensory experience. There is, however, so far as we are aware, no experimental evidence of an attributive basis of temporal order, while there are many experimental indications that this order is perceptive.—Aside from these special considerations (4) we cannot convince ourselves that order stands, as an attribute, on the same logical level with the acknowledged attributes of sensation.

The present Study is concerned with one of Watt's particular illustrations. "On the skin," he remarks, "it is found that every nerve-ending and every touch-spot can be distinguished from every other, with the exception, perhaps, of those that lie too close together to allow of isolated stimulation."[3] The statement repeats a generalisation of Thunberg's;[4] and Thunberg is repeating, somewhat uncritically, statements of von Frey and Metzner. These investigators, who worked only on the middle third of the forearm and (to a less extent) on the wrist, conclude from their results that "am Unterarm, *und wohl auch sonst am Körper*, wo es gelingt benach-

[1] H. J. Watt, The Elements of Experience and Their Integration: or Modalism, *Brit. J. Psych.*, iv., 1911, 127 ff.

[2] E. Kaila, Versuch einer empiristischen Erklärung der Tiefenlokalisation von Doppelbildern, *Z. f. Psych.*, lxxxii., 1919, 146.

[3] *Op. cit.*, 157. The 'perhaps' seems a little mild.

[4] T. Thunberg, Nagel's *Handbuch d. Physiol. d. Menschen*, iii., 1905, 721.

barte Endorgane des Tastsinns isolirt zu erregen, eine Unterscheidung derselben möglich ist, richtige Versuchsbedingungen vorausgesetzt" (italics ours). A little later they say: "Wir glauben..den Satz aussprechen zu dürfen, dass auf allen Tastflachen, auf welchen eine isolirte Erregung einzelner Tastpunkte gelingt, die Successivschwellen bei günstigen Auffassungsbedingungen den Abständen der Tastpunkte merklich gleichwertig sind."[5] It is clear that von Frey and Metzner are outrunning their facts by inference; but it is clear also that they are careful to distinguish inference from observed fact. Thunberg and Watt speak as if the whole bodily surface, and not the forearm only, had been explored.

We thought it worth while to test the Thunberg-Watt generalization on a part of the body that should be as free as possible from the influence of empiristic motives (visual images, reflexes). For obvious reasons, we chose the back. In a preliminary study the whole back was worked over, in the effort to find an area in which the sensory response of the pressure-spots should be attributively the same. In order that only cutaneous sensations should be aroused, we sprayed the back lightly with ether, and so adjusted the hair-aesthesiometer that, under these conditions, no sensation appeared.

We obtained the most satisfactory results from the area between the scapulae. Over a certain part of this area, moreover, lying on either side of the vertebral column between the seventh and tenth cervical vertebrae,—the part measured 33 to 40 mm. in width above, and 20 to 27 mm. below,—we found that the *Os* could not tell *whether the right or left side of the back was under stimulation*. The pressure of the hair could be roughly localized, but could not be referred to right or left of the vertebral column.[6] This result in itself led us to think that Watt's generalization would prove to be overhasty.

For purposes of tabulation, the inter-scapular area was divided into four sub-areas. The left side of the part wherein the *Os* failed to distinguish right and left we term Area I, the right side Area II. The remainder of the left Area we term Area III, and the remainder of the right area Area IV. For stimulation we had recourse to a modified Benussi kinohapt,[7] controlled by the Leipzig time-sense apparatus set to give an interval of 4/3 sec. between the stimulations; this is the interval recommended by von Frey and Metzner.[8] The duration of stimulation was 0.3 sec. The hair-constants varied for the three *Os*: B, 0.51 gr/mm; D, 0.68; H, 0.42. The current operating the kinohapt was checked several times during an observational period. At the beginning of every hour 16 pressure-spots were selected, two lying vertically and two horizontally in every one of the four areas. We never stimulated neighboring spots, but allowed at least one spot between the members of a pair. The number of spots involved in this way varied from 3 to 38; the number of intermediates was always counted. We made out 20 combinations of the 16 selected spots: vertical and horizontal within every area, and vertical and horizontal in all combinations of the areas.

The *Os* were: Dr. H. G. Bishop (B), instructor in psychology; Dr. K. M. Dallenbach (D), assistant professor of psychology; and Dr. L. B. Hoisington (H), assistant professor of psychology. D and H were highly practised in cutaneous observation; B had not observed before in a similar

---

[5]M. von Frey und R. Metzner, Die Raumschwelle der Haut bei Successivreizung, *Z. f. Psych.*, xxix., 1902, 173 f.

[6]Dr. Titchener informs us that this experience of the impossibility of right-left localization at a certain place between the shoulder-blades may be had during Swedish massage.

[7]*Arch. f. d. g. Psych.*, xxix., 1913, 385 ff.

[8]*Op. cit.*, 176.

TABLE I

PERCENTAGE OF JUDGMENTS OF 'SAME' IN SERIES I

	Area	I	II	III	IV	I-II	I-III	I-IV	II-III	II-IV	III-IV
Horizontal	B	40	0	20	30	0	0	0	0	0	20
	D	30	30	50	70	0	20	0	0	20	0
	H	60	40	50	10	20	0	0	40	60	0
Vertical	B	10	20	30	20	0	20	0	0	0	0
	D	50	20	40	10	20	0	0	0	20	0
	H	20	30	40	20	40	20	0	0	40	0
Average		35	23.3	38.6	26.6	13.5	10	0	—	33.3	—

TABLE III

TOTAL NUMBER OF STIMULATIONS AND NUMBER OF JUDGMENTS OF 'SAME' FOR SEPARATIONS IN MM.

Separation	0–5	6–10	11–15	16–20	21–25	26–30	31–35	36–40	41–45	46–50	51–55
B	13 / 3	28 / 6	12 / 2	10 / 0	30 / 4	15 / 2	11 / 2	5 / 2	4 / 0	5 / 0	1 / 0
D	16 / 8	25 / 10	13 / 4	20 / 6	22 / 5	16 / 1	6 / 0	5 / 0	5 / 0	5 / 0	1 / 0
H	20 / 8	23 / 9	15 / 2	21 / 7	17 / 5	10 / 2	18 / 3	5 / 0	4 / 0	3 / 1	3 / 0
Percent. Same	38	33	20	23	20	12	14	—	0	—	0

experiment. The *Os* were instructed to attend to the cutaneous sensations set up by the stimulus, and to localize them with respect to each other. In the preliminary work the *Os* lay prone, the head resting on a cushion and the kinohapt placed over the back; but breathing led to disturbing movements which were not wholly eliminated even when the breath was held. We then tried placing cushions under chest and abdomen; but still the movements were disturbing. We then seated the *Os* in a chair, with the back supported below the area stimulated; movements were reduced, but even so were not eliminated. Finally we seated the *Os* in a chair with the back supported both above and below the area: this arrangement proved satisfactory.

After completing Series 1, in which two different spots were stimulated in every observation, we undertook a Series 2, in which (within all four areas only) a single spot was twice stimulated; the *Os*, of course, were not informed of the plan of the series. The results of both Series are given in Tables I-IV. Table I shows the percentage of judgments of 'same' in Series 1. Table II shows the same percentage in Series 2. Table III shows the total number of stimulations and the total number of judgments of 'same' for the separations grouped in 5 mm. intervals, together with the percentage of judgments of 'same' for every interval. Table IV shows the total number of stimulations and the total number of judgments of 'same', together with the percentages of judgments of 'same', in terms of the number of pressure-spots involved.

The following are some of the reports:

Series 1. *Same.* B

(1) Localized at the same place; 2 was prick, 1 was weak. (Pressure-spots, 12; separation 26 mm.)

(2) Localized at the same place; 2 was like an after-image. (Pressure-spots, 4; separation, 6 mm.)

(3) Localized in the same area; 1 was large, 2 was small. (Pressure-spots, 4; separation, 5 mm.)

(4) Localized at the same place; 2 was weaker than 1. (Pressure-spots, 4; separation, 7 mm.)

D

(1) Localized at the same place; both were weak and diffuse. (Pressure-spots, 10; separation, 20 mm.)

(2) Localized in the same area; 1 was contact, medium to weak intensity and diffuse, area was size of the thumb; 2 followed immediately, contact, medium to strong intensity, small area. Cannot say whether same or different spots. (Pressure-spots, 12; separation, 16 mm.)

(3) Localized in the same place as two contacts. (Pressure-spots, 8; separation, 13 mm.)

(4) Localized at the same place; same size and intensity. (Pressure-spots, 10; separation, 16 mm).

(5) Localized at the same place; 1 was pressure, 2 was prick. (Pressure-spots, 3; separation, 4 mm.)

TABLE II

PERCENTAGE OF JUDGMENTS OF 'SAME' IN SERIES 2

Area	I	II	III	IV
B	30	70	90	30
D	90	50	60	80
H	20	40	10	20
Average	46.6	53.3	53.3	43.3

TABLE IV

TOTAL NUMBER OF STIMULATIONS AND NUMBER OF JUDGMENTS OF 'SAME' IN TERMS OF PRESSURE SPOTS INVOLVED

Pressure Spots	3	4	5	6	7	8	9	10	11	12
B	13 2 2	17 4	9 3	4 1	4 0	6 1	5 0	7 1	18 1	9 2
D	11 4	18 7	9 5	3 1	3 0	6 2	10 2	15 6	6 5	7 1
H	13 5	14 5	9 4	6 1	5 2	7 2	10 4	12 3	5 0	5 1
Percent. Same	29.8	32.7	44.5	23.1	—	26.3	24.0	29.4	20.7	19.0

Pressure Spots	13	14	15	16	17	18	19	20	23	26
B	5 0	0 0	3 0	9 2	8 1	2 1	1 0	1 1	3 1	1 0
D	6 0	4 0	6 0	7 0	3 0	6 1	2 0	0 0	0 0	1 0
H	6 0	11 3	4 2	4 0	7 1	3 0	5 2	4 0	3 1	2 1
Percent. Same	0	—	—	—	10.1	18.4	—	—	33.3	—

H

(1) Localized at the same place. (Most of the reports in which there was a judgment of 'same' were given in this way.)
(2) Localized in the same area; 1 was spread down, 2 was spread up. The two were not over each other, but there was no difference in the place touched. (Pressure-spots, 9; separation, 16 mm.)

Series 1. *Different.* B

(1) 2 was 1.5 cm. right of 1; 1 fell down and wabbled around, 2 was pure pressure. (Pressure-spots, 5; separation, 9 mm.)
(2) 2 was 1.5 cm. below and right of 1; same quality, intensity, and extensity. (Pressure-spots, 5; separation, 9 mm.)

D

(1) 1 was neutral pressure, followed by 2 which had the same quality as 1. 2 was first localized in the same area as 1 and then moved diagonally to the left and up ½ in. where it became itch. (Pressure-spots, 8; separation, 13 mm.)
(2) 1 was large; 2 was in the area of 1 and was small, but the centers were not the same. (Pressure-spots, 4; separation, 5 mm.)
(3) 1 was pressure, 2 was prick; the spots were different but don't know separation or direction. (Pressure-spots, 3; separation, 5 mm.)
(4) 2 was at the top edge of 1. (Pressure-spots, 10; separation, 21 mm.)

H

(1) Both touched different edges of the same spot. (Pressure-spots 12; separation, 20 mm.)
(2) 2 was just below 1. The two pressure areas touched. (Pressure-spots, 4; separation, 5 mm.)
(3) 2 was at the right edge of 1; 2 was big and diffuse. (Pressure-spots, 14; separation, 21 mm.)
(4) 2 was at the bottom edge of 1. (Pressure-spots, 10; separation 16 mm.)
(5) Localized in the same area but having different centers. (Pressure-spots, 9; separation, 16 mm.)

Series 2. *Same.* B

(1) The spots piled up on each other.
(2) Localized at the same place. Seemed to be a long *one.*
(3) Both stayed in the same place and wiggled; size and feeling of a small camel's-hair brush.
(4) Localized at the same place; was as though the hair was bent down along the back.

D

(1) Same in quality, extensity and intensity.
(2) Localized in the same place; weak, contact, diffuse.
(3) Localized in the same place; dull diffuse pressure .

H

(1) Localized at the same place.

Series 2. *Different.* B

(1) 2 was below and right of 1.
(2) Spots very close together.

D

(1) 2 was below and left of 1; 1 was neutral pressure, definite localization; 2 was contact, diffuse, not definitely localized.

(2) No definite localization; spots were perceived as different in location and quality.

H

(1) The two areas overlapped but had different centers.

(2) 2 was 1.5 cm. above 1.

(3) 2 was 1 cm. below 1. 2 was spread out and almost touched 1.

We note in Table I that stimulation within a single area gives a large percentage of judgments of 'same', and a larger percentage on the left than on the right side. Stimulation on both sides of the vertebral column (as I-IV, II-III) gives only a very small percentage of 'same'; except in the two central areas (I-II), where we had found in the preliminary work that there is no rightness or leftness, the judgments of 'same' are about half as numerous as those of the single areas. When the areas stimulated lie on the same side of the spine, there is again a large percentage of 'same', but now the right side gives the higher values.

Table II shows that, when we stimulated a single spot twice over, the *O*s reported 'same' in only about 50 per cent of the cases.

Table III shows that the percentage of judgments of 'same' decreases as the separation of the spots increases. We find, however, one judgment of 'same' for a separation of 46-50 mm.

Table IV resembles Table III. The greatest percentage is for 5 pressure-spots, but there is one judgment of 'same' for 26 spots.

Although we tried to secure an attributive identity of the cutaneous sensations, there were of course many occasions when difference was reported. Judgments of 'same' (identical locality) occurred when the sensations were attributively different, and judgments of 'different' (different locality) when the sensations, as reported, were attributively the same.[9]

Conclusions

It is clear that, whatever may be the basis of cutaneous localization (and we have no intention of attempting a theory in the present Study), Watt's generalization, offered in support of his hypothesis of an attributive order, is not valid. "On the skin it is found that every nerve-ending and every touch-spot can be distinguished from every other, with the exception, perhaps, of those that lie too close together to allow of isolated stimulation" —this statement not only, at the time of its printing, went beyond the experimental facts, but is now shown also to be at variance with experimental facts. Different laws hold for different parts of the cutaneous surface. Our results, moreover, obtained as they were on an area as free as possible from the influence of empiristic motives, suggest that localization is in general a matter rather of perception than of sensation.

---

[9]The phenomenon of movement was reported on several occasions. Cf. von Frey and Metzner, *op. cit.*; V. Benussi, *op. cit.*; J. H. Burtt, *J. E. P.*, ii, 1917, 371 ff.; A. K. Whitchurch, this JOURNAL, xxxii., 1921, 472 ff.